

Mission Restoration Project

Botany Specialist Report and Biological Evaluation

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for:
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Field Code Changed

Regulatory Framework

Land and Resource Management Plan

The Okanogan National Forest Land and Resource Management Plan (LRMP) provides standards and guidelines (S&G) for Threatened, Endangered, or Survey and Manage plant species. S&G 6-19 addresses Sensitive species, stating, "Sensitive plants and animals should be protected."

Manual Policy and Direction

Chapter 2670 of the Forest Service Manual (FSM), quoting Departmental Regulations 9500-4, directs the Forest Service to:

- Manage "habitats for all existing native and desired nonnative plants, fish, and wildlife species in order to maintain at least viable populations of such species."
- Conduct activities and programs "to assist in the identification and recovery of threatened and endangered plant and animal species."
- Avoid actions "which may cause a species to become threatened or endangered." (FSM 2670.12)

The Manual further identifies Forest Service objectives (FSM 2670.2) and policies (FSM 2670.3) regarding federally threatened and endangered and sensitive species.

Objectives identified include:

- Manage National Forest System habitats and activities for threatened and endangered species to achieve recovery objectives so that special protection measures provided under the Endangered Species Act are no longer necessary.
- Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.

While stated policies include:

- Assist states in achieving their goals for conservation of endemic species.
- Review programs and activities as part of the National Environmental Policy Act of 1969 process through a biological evaluation, to determine their potential effect on threatened and endangered species, species proposed for listing, and sensitive species.
- Avoid or minimize impacts to species whose viability has been identified as a concern.
- Analyze, if impacts cannot be avoided, the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole. (The line officer, with project approval authority, makes the decision to allow or disallow impact, but the decision must not result in loss of species viability or create significant trends toward federal listing.)

Sensitive Species are defined as those plants and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution (FSM 2670.5).

Chapter 2620 of the Forest Service Manual addresses management for biological diversity and species viability. The FSM requires a project to consider the distribution and abundance of plant and animal species, and their community requirements in order to meet the overall multiple-use objectives and to provide a sound base of information to support management decision-making affecting wildlife and fish, including endangered, threatened, and sensitive animal and plant species, and their habitats. Managing for species viability requires that habitat must be provided for the number and distribution of reproductive individuals needed to ensure the continued existence of a species throughout its geographic range.

Federal Law

The Endangered Species Act of 1973 (16 USC 1531 et seq.) requires that any action authorized by a federal agency shall not be likely to jeopardize the continued existence of a threatened or endangered (T&E) species, or result in the destruction or adverse modification of habitat to such species that is determined to be critical.

Survey and Manage

This document and analysis tier to the Okanogan National Forest Land and Resource Management Plan FEIS and Record of Decision 1989 (Forest Plan), as amended by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl 1(NWFP) and its subsequent January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. The 2003 Survey and Manage species list was used for this analysis (See project file for the 2003 Survey and Manage List).

Watershed Analysis

The Lower Methow Watershed Analysis (1999), which addresses the Libby Creek sub-watershed, recommends performing surveys for Threatened, Endangered, and Sensitive plant species and habitats that are at risk of disturbance. The Watershed analysis recommends that a survey list and management recommendations be developed for Threatened, Endangered and Sensitive species. There are no Threatened or Endangered plant species within the project area. Sensitive plant species on the R6ISSSSP list (Interagency Special Status & Sensitive Species Program), will be analyzed. Design criteria and mitigations have been developed to manage populations where they coincide with project activities.

The Twisp River Watershed Analysis (1995), which addresses the Buttermilk Creek sub-watersheds, recommends performing surveys, monitoring and delineating habitat for sensitive grape fern (*Botrychium spp.*).

Affected Environment and Environmental Consequences

Considered But Not Analyzed in Detail

Figure 1: Resources Considered But Not Analyzed in Detail

Resource	Rationale for Dismissing from Further Analysis
Endangered Plant Species	Two Endangered plant species are known to occur on the Okanogan-Wenatchee National Forest; showy stickweed (<i>Hackelia venusta</i>) and Wenatchee Mt. checker-mallow (<i>Sidalcea oregana</i> var. <i>calva</i>). There are no known populations of these species on the Okanogan portion of the Forest. These species were not located during field inventory and there is no suitable habitat for them within the project area.
Threatened Plant Species	Two Threatened plant species are known to occur on the Okanogan-Wenatchee National Forest; water howellia (<i>Howellia aquatalis</i>) and Ute ladies'-tresses (<i>Spiranthes diluvialis</i>). There are no known populations of these species on the Okanogan portion of the Forest. These species were not located during field inventory and there is no suitable habitat for them within the project area.

Sensitive and Survey and Manage (S&M) Plant Species	There is one R6 Sensitive species, <i>Pinus albicaulis</i> (whitepark pine) and two S&M species, <i>Mycena overholtsii</i> (Cat B fungi) and <i>Botrychium montanum</i> (Mountain moonwort- Cat A vascular plant), which occur within the project boundary. Populations of <i>P. albicaulis</i> , <i>Mycena overholtsii</i> and <i>Botrychium montanum</i> occurring within the analysis area, but in isolated locations where there would be no effects from the proposed treatments, will not be analyzed.
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Resource Indicators and Measures

Figure2: Resource Indicators and Measures for Assessing Effects

Resource Element	Resource Indicator	Measure (Quantify if possible)	Used to address: P/N, or key issue?	Source (LRMP S/G; law or policy, BMPs, etc.)?
R6 Sensitive plant <i>Botrychium crenulatum</i>	Viability of occupied <i>B. crenulatum</i> habitat	Poor, Fair, or Good	P&N # 5	S/G 6/19, FSM 2620, FSM 2670
	Population and individual plant count and vigor	Numbers of populations or individual plants	P&N # 5	S/G 6/19, FSM 2620, FSM 2670
Unique and Sensitive Plant Habitats	Change in aspen stand vigor and plant biodiversity	Acres of unique and sensitive habitat treated	P&N # 5	FSM 2670.2 and FSM 2670.3
Understory Vegetation Composition	Change in amount and diversity of understory vegetation	Acres of forest canopy opened	P&N # 3	FSM 2670

Methodology and Impact Level Definitions

The methodology used to analyze each resource indicator is described below.

Prior to conducting botanical surveys for Sensitive and Survey and Manage (S&M) plant species, all existing data regarding known populations and habitats in the project area was analyzed. Data was collected from Methow Valley Ranger District (MVRD or District) past botanical survey records, Natural Resource Information System (NRIS), and the Washington Natural Heritage Program (WNHP) rare plant database. Habitat data was compiled from prior survey data as well as Okanogan-Wenatchee National Forest GIS layers. Species on the 2015 Region 6 Regional Forester's Interagency Special Status Species list were surveyed for this analysis (See project file for the R6 list). The surveys were conducted at the time of year when plants are identifiable. The Intuitive Controlled method was used to conduct surveys. This method is defined as follows: The surveyor has given the area a closer look by conducting a complete survey through a specific area of the project after walking through the project area and

perimeter or by walking more than once through the area. Most of the project area is examined (USDA-FS 2005).

Spatial and numerical data collected are stored in the Region 6 Natural Resource Information System database. Effects are analyzed by determining where disturbance will overlap with R6 Sensitive and S&M populations, determining the nature and level of disturbance, and assessing plant's vulnerability to the disturbance.

All known R6 Sensitive and S&M populations documented in the project area were delineated and mapped. When populations were small enough, exact counts of individuals were taken. For larger populations, the number of individuals was estimated based on smaller subsets of data. Acreage of each population was determined using GIS software.

This project uses information from photo interpretation, field reconnaissance, and analysis results of the Ecosystem Management Decision Support (EMDS) tool to identify restoration and wildfire hazard reduction needs at the stand and landscape levels in the project area. A majority of the Unique and Sensitive Habitats were areas identified by the North Central Washington Forest Health Collaborative (NCWFHC) that focused on aspen restoration. The Forest Service used the GIS deciduous vegetation models and National Agriculture Imagery Program (NAIP) aerial imagery to identify additional Unique and Sensitive Habitats.

The same models and methods above were used to identify forested habitats for restoration treatments where understory vegetation composition would be enhanced and maintained by treating overstory vegetation.

Resource Indicator: Viability of occupied *B. crenulatum* habitat and population and individual plant count and vigor

Identification of threats is somewhat challenging for moonworts (which includes *B. crenulatum*), since so much information is still needed on habitat requirements, environmental tolerances and the effects of management. In a conservation assessment written by Ahlenslager and Potash, 2007, threats to moonworts in Oregon and Washington (ORNHC 2002 and WNHP 2002) are actions that alter existing site characteristics, including actions that would change the microclimate, canopy coverage, hydrology, or mycorrhizal association on a site from the regime that has supported a given population over the past decade. The moderate threat from logging and other vehicular activities is the actual physical disturbance of the soil that breaks root and mycorrhizae connections or otherwise uproots the moonwort plants (Ahlenslager and Potash, 2007). Some *B. crenulatum* populations would be excluded from both thinning and prescribed fires treatments, while others would be included in order to improve population vigor. In sites where treatments would be avoided, established boundaries around plant locations have been delineated, and a 50-foot buffer would be applied. All *B. crenulatum* populations involved in project treatments would be monitored over the course of the project and the results of this monitoring may result in modifications of design criteria.

Indicator: In this analysis, viability of occupied *B. crenulatum* is measured as good, fair or poor. A rating of good means actions over the last decade have not altered the habitat requirements listed above for occupied *B. crenulatum*. A fair rating means there have been some habitat alterations over the last decade. Under a fair rating, populations have remained stable but may experience a downward trend as habitat viability is at risk due to actions that has changed the microclimate. A rating of poor would mean the viability of the occupied habitat has been on a downward trend, and *B. crenulatum* within that habitat have been decreasing in numbers over the past decade. Population count and vigor of *B. crenulatum* near treatment areas will be documented, where accidental or unforeseen treatment effects to Sensitive plant populations has occurred. Population count and vigor of *B. crenulatum* that have been included in treatment areas.

Analysis Methods: Funding implementation, including monitoring will be scheduled and requested on a yearly basis. Monitoring would occur ~~before and after proposed treatments~~ at all ~~Sensitive plant~~ *B. crenulatum* populations within unit boundaries.

Analysis Area: *B. crenulatum* sites within the project area and their immediate surrounding habitats would be analyzed.

Resource Indicator: Change in aspen stand vigor and plant biodiversity

In dry east-side forests, aspen and wetland ecosystems are limited across the landscape and are biodiversity hotspots for wildlife and plant species. These unique habitats usually have deeper, richer soils than the surrounding coniferous forests. The partial shading overstory and rich soil in the understory supports many herbs, forbs, and grasses in the understory community (Seager et al. 2013). Aspen's palatable twigs and foliage, and tendency to develop cavities, make it valuable habitat for wildlife such as deer (*Odocoileus* sp.), elk (*Cervus elephas*), woodpeckers, and songbirds (Swanson et al. 2010). Mature competing conifers can suppress aspen overstory trees, and conifers of any size can suppress growth of aspen suckers. In addition, conifers compete strongly for soil moisture with aspen in an environment where moisture is often in short supply (Swanson et al. 2010). Succession of aspen to conifers in our area is driven by both the greater shade tolerance of the conifers, and by competition for moisture (Swanson et al 2010). Conifers intercept more moisture than aspen, especially snow (DeByle 1985c).

Indicator: Aspen stand and wetland vegetation vigor. Increase of vegetation and biodiversity of plant species.

Analysis Methods: Funding implementation, including monitoring will be scheduled and requested on a yearly basis. Monitoring would occur in select aspen stands and wetlands within the project area, ~~prior to treatment, over the life of the project and afterward.~~

Analysis Area: Sensitive and Unique habitats within the project area were analyzed

Resource Indicator: Change in amount and diversity of understory vegetation

Analysis relies on a comparison of the amount of cover and diversity of native species before and after treatment.

Indicator: Increase/Decrease in Amount/Diversity of Cover

Analysis Methods: Funding implementation, including monitoring will be scheduled and requested on a yearly basis. Monitoring would occur in select areas within the project area prior to treatment, over the life of the project, and afterward.

Analysis Area: Select forested areas proposed for restoration treatments.

Impact Level Definitions

The definitions below will be used to describe effects of the proposed actions on botanical resources.

Impact Types for botanical resources are:

- Beneficial: An increase in *B.crenulatum* populations/ species count and vigor near treatment areas. An increase in aspen stand vigor and plant diversity in unique habitats. An increase in the amount and diversity of understory vegetation.
- Adverse: A decrease in *B.crenulatum* populations/species count and vigor near treatment areas. A decrease in aspen stand vigor and plant diversity in unique habitats. A decrease in the amount and diversity of understory vegetation.

Impact Durations for botanical resources are:

- Short term: Immediately through the first growing season after treatments.
- Long term: 1 to 20 years.

Impact Intensities for botanical resources are:

- Negligible: A change to botany resources that would be so small that it would not be of any measurable or perceptible consequence. Sensitive plants, unique habitats and understory vegetation would not be affected or the effects to these plants would not be detectable.
- Minor: Change to sensitive plants, unique habitats and understory vegetation would be detectable, although these effects would be localized and of little consequence. Minor effects to understory vegetation would be less than half an acre in any given location. Activities would not physically disturb individual sensitive plants. Unique habitats may experience alterations, however, overall ecological functioning would be inconsequential and immeasurable.
- Moderate: A change to botany resources that would be readily apparent and measurable. Measurable effects could include physical disturbance or removal of sensitive plants, and disturbance to unique habitats and understory vegetation. Disturbance to understory vegetation would be more than half an acre in any given location.
- Major: Effects to sensitive plants, unique habitats and understory vegetation would be readily apparent, measurable, severe, and would occur on a regional scale. The viability of plant populations, unique habitats and understory vegetation would be altered.

Mitigation measures to offset effects would be extensive and success would not be assured.

Affected Environment

Botrychium crenulatum (scalloped moonwort) is considered a Sensitive species according to the Region 6 ISSSSP 2015 list. *B. crenulatum* occurs within, or in close proximity to unit boundaries.

Habitats for *B. crenulatum* will be discussed and analyzed, as populations of this species are either within unit boundaries or in close proximity.

Figure3: Resource Indicators and Measures for the Existing Condition

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Existing Condition (Alternative 1)
R6 Sensitive plant <i>Botrychium crenulatum</i>	Viability of occupied <i>B. crenulatum</i> habitat	Poor, Fair, or Good	Fair
	Population and individual plant counts of <i>B. crenulatum</i>	Numbers of populations or individual plants	5 populations totaling 40 individuals
Unique and Sensitive Plant Habitats	Change in aspen stand vigor and plant biodiversity	Acres of unique and sensitive habitats treated	0 acres
Understory Vegetation Composition	Change in amount and diversity of understory vegetation	Acres of forest canopy opened	0 acres of forest canopy opened. Sparse or no understory in areas with closed canopy.

Resource Indicator: Viability of occupied *B. crenulatum* habitat

Two proposed treatment units (16 and 503) have known populations of *B. crenulatum*. There are patches of dense conifer canopy surrounding the occupied habitat in these units. Encroaching conifers could displace riparian trees and shrubs that are associated with *B. crenulatum* habitats. Dense stands of conifers could also lead to a high severity fire which could mean a long recovery time for vegetation. Conifer encroachment and the potential for fire processes occurring outside their biophysical baseline conditions in the occupied sites, makes the current surrounding habitat fair quality.

Resource Indicator: Population and individual plant counts of *B. crenulatum*

Five populations of the R6 Sensitive plant, *B. crenulatum* occurs within the analysis area in moist- wet riparian areas with saturated soils, dominated by riparian vegetation such as

Populus tremuloides (aspen) and *Cornus sericea* subsp. *sericea* (redosier dogwood). *B. crenulatum* requires nearly permanent moisture, often occurring in saturated headwater fens and seeps (Farrar, 2006). It is usually found in partly shaded to heavily shaded sites at mid to high elevations (Farrar, 2005). There is an accumulation of downed debris and a dense overstory and understory of both riparian and upland vegetation. Conifer encroachment and fire behavior outside the range of scientifically acceptable ecological consequences could be a threat to these sites.

Two populations, totaling 9 individuals occurs in riparian habitats within proposed treatment units, and three populations totaling 31 individuals occurs in riparian habitats outside unit boundaries.

Resource Indicator: Change in aspen stand vigor and plant biodiversity

Unique and Sensitive Plant Habitats are dominated by aspen and other deciduous riparian vegetation. Aspen stands within some units have a multi-age structure where mature aspen dominate the overstory and younger aspen are establishing where the overstory canopy has opened. Other stands have a single age structure, where mature aspen dominate the overstory but young aspen regeneration is limited by both conifers and mature aspen. Conifer encroachment in the overstory and understory within these habitats are limiting available sunlight, nutrients and water on which the riparian vegetation depend.

Conifer encroachment and closed canopies are limiting available nutrients, water and sunlight to the riparian vegetation in unique and sensitive plant habitats.

Resource Indicator: Change in amount and diversity of understory vegetation

Current conditions in the forested area in the two sub-watersheds are dominated by dense, multi-layered forest. In the Libby Creek sub-watershed, there is an excess of small patches of dense, young trees. The Buttermilk sub-watershed has excessive areas and large patch sizes of dense, multi-story forests. Current overstory vegetation conditions are decreasing the amount and diversity of understory vegetation composition.

The understory vegetation composition in the analysis area is decreasing in amount and diversity due to lack of available resources caused by closed canopies and dense patches of young trees.

Environmental Consequences

Proposed Actions Dismissed from Further Consideration

Botanical resources would not be affected by proposed transportation changes (closing, opening, or decommissioning roads), culvert replacement, coarse woody debris enhancement, or soil treatments as these activities would not occur in locations that have known populations of

R6 Sensitive plants species. The activities mentioned above would have negligible effects on unique and sensitive habitats and understory vegetation.

Alternative 1 – No Action

Under a no-action alternative, existing populations of *B. crenulatum* would remain stable in the short-term, but plant vigor within these populations would decrease due to competition for light, water and nutrients from dense over/understory vegetation. A no-action alternative would have long term, ~~major~~ moderate adverse impact from canopy closure on *Botrychium crenulatum* populations, unique and sensitive habitats and understory native plant species. In addition, there would be long term ~~major~~ moderate adverse impact on *B. crenulatum* and unique and sensitive habitats from potential stand replacement fire. Unique and Sensitive habitat conditions would deteriorate over time due to the encroachment of conifers from lack of thinning and prescribed fire treatments. There would be a trend of overstory and understory tree build-up due to the lack of thinning and prescribed fire, which could contribute to large wildfires in the future and would decrease the amount and diversity of understory vegetation composition.

Alternative 2 – Proposed Action

Project Design Features and Mitigation Measures

The same Design Features and Mitigation Measures listed under Alternative 2 would be applied for Alternative 3.

Figure4: Design Features

Number	Design Feature	Why Necessary	Efficacy	Consequence of Not Applying
18	Where R6 Sensitive and Survey and Manage plants occur or are suspected to occur in harvest, thinning and underburn units, maintain shading sufficient to protect the plant's micro-site conditions. In most cases, the equipment buffer zone for Riparian Reserves will be adequate. The District Botanist will assess the need for additional protection of sensitive sites during unit layout. All ground disturbing activities, including aquatic and beaver habitat enhancements within occupied R6 Sensitive and Survey and Manage plant habitats will be coordinated with the District Botanist. Maps and descriptions of specific avoidance areas will be provided for Units 16 and 503, and aquatic and beaver habitat enhancement activities where R6 Sensitive occur.	Minimize disturbance and maintain sufficient shading to protect R6 Sensitive and Survey and Manage microsite conditions	Moderate	Existing R6 Sensitive and Survey and Manage plants and micro-site conditions would not be protected, which could lead to a loss of vigor, populations and species.

19	<p>Conifer canopy closure within aspen stands in harvest units will not exceed 10% conifer closure following treatment. This will be accomplished by retaining, on average, a maximum of 10 conifer stems per acre larger than 10" dbh following treatments including the adjacent areas located within 50' of treated aspen tree stand perimeters.</p> <p>Five or more healthy aspen, 5 ft. tall in a 15" radius will be the minimum size when considering treatment. The largest conifers, including trees 21" DBH, and larger, and defective trees most favorable for wildlife will be retained in aspen stands. Douglas-fir and subalpine fir 21 to 24 inches DBH with an estimated age of less than 150 years would be harvested where needed to achieve desired conifer stocking levels.</p>	<p>Within Aspen Release Units, reduce conifer canopy closure in aspen and other deciduous tree stands to reduce competition with aspen and other deciduous trees and provide trees favorable for wildlife.</p>	Moderate	<p>Competing conifers would suppress aspen overstory trees, and suppress growth of aspen suckers. Conifers would compete strongly with aspen for soil moisture, sunlight and nutrients.</p>
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20	<p>Treatments occurring within existing aspen stands with five or more healthy aspen, 5 ft. tall, in a 15" radius and in a 50 foot wide buffer located adjacent to aspen stand perimeters. Desired treatment objectives include 10 percent or less canopy closure contributed by conifers following treatment within aspen stands and the adjacent buffer. A maximum stocking level of approximately ten conifers per acre larger than 10 inches DBH following treatment within aspen stands and the buffer. Conifers 10 inches DBH and smaller would be felled with chainsaws (no ground disturbing mechanized equipment) to reduce conifer encroachment. Conifers larger than 10 inches DBH and less than 21 inches DBH would be girdled with chainsaws and left standing to attain desired conifer canopy closure treatment objectives. All conifers 21 inches dbh and larger would be retained in aspen stands and the adjacent buffers even if conifer stocking exceeds the desired maximum retention level.</p>	<p>Non-commercial thinning and girdling treatment of conifers to release existing aspen trees from conifer encroachment and promote the establishment of aspen and other hardwood regeneration. This treatment would be applied to reduce conifer competition for sunlight and soil moisture, improve the vigor of existing aspen clones, and stimulate sprouting of new aspen stems where conifers have invaded or are shading out aspen stands.</p>	Moderate	<p>Competing conifers would suppress aspen overstory trees, and suppress growth of aspen suckers. Conifers would compete strongly for soil moisture, sunlight and nutrients with aspen.</p>
21	<p>Burning will retain 90% of existing coarse woody debris less than 6 inches in diameter in and around R6 Sensitive and Survey and Manage plant habitats.</p>	<p>Limit cattle access to Sensitive and Survey and Manage plant habitats.</p>	Moderate	<p>Cattle access may become easier in R6 Sensitive and Survey and Manage plant habitats, causing trampling and browsing of plants.</p>

22	Minimize soil compaction and disturbance in aspen stands	In aspen overstory thin units 21, 22 and 24, a slash mat will be used during machine piling.	Moderate	Soil compaction in aspen stands could decrease water uptake to aspen and plants within aspen stands. Plants and aspen roots could be damaged by mechanized equipment during implementation that could lead to decreased vigor and health.
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Figure 7: Mitigation Measures

Comment [TMM-1]: These all seem like Design Criteria to me because they prevent effects rather than mitigate impacts. What do you think?

Number	Mitigation	Why	Efficacy	Consequences
23	Within harvest and aspen release units 16 and 503 and aquatic and beaver habitat enhancement activities, <i>Botrychium</i> populations will be flagged identified and avoided to mitigate direct impacts to the population. To mitigate affects to the sensitive habitat, directional felling, equipment exclusion zones, or other skidding restrictions will be used. Unit 16 should be underburned at a time when soils within the population are saturated in order to limit fire spread into the population.	Mitigate impacts to botanical resources in Units 16 and 503 (known locations of Sensitive plants)	Moderate	Populations of <i>Botrychium</i> may be lost to management actions

24	Minimal ground disturbance activities will be allowed in occupied or potentially occupied R6 Sensitive and Survey and Manage plant habitats such as perennially wet sites and areas with riparian vegetation.	Minimize impacts to occupied or potentially occupied Sensitive plant habitat, perennially wet sites, and riparian areas.	Moderate	Existing R6 Sensitive and Survey and Manage plants and potential sensitive plant habitat will not be protected.
25	Limited piling and burning will be allowed in aspen stands greater than ¼ acre (100' X 100') that occur within harvest units. Piles will be at least 6' from the nearest bole and will not exceed 8 feet in diameter. The area burned within an aspen stand will not exceed 15% of the stand area. In Conifer Girdling for Aspen Restoration units, the District Botanist will coordinate pile sizes and locations with the Fuels Specialist and Timber Sale Administrator.	Minimize impacts of piling and burning in aspen stands.	Moderate-High	Due to the concentration of heat in burn piles, aspen trees that are too close or piles that are larger than 8 feet in diameter may kill individual trees and scorch the soil which damages underground root growth that producing aspen suckers.

Environmental Consequences

Botanical resources would not be affected by proposed transportation changes (closing, opening, or decommissioning roads), culvert replacement, coarse woody debris enhancement or soil treatments as these activities would not occur in locations that have known populations of R6 Sensitive plants species. The activities mentioned above would have negligible effects on unique and sensitive habitats and understory vegetation.

The effects for R6 Sensitive plants in alternative 2 would be the same as those described for alternative 3.

Figure5: Resource Indicators and Measures for Alternative 2and 3

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternatives 2 and 3
R6 Sensitive plant <i>Botrychium crenulatum</i>	Viability of occupied <i>B. crenulatum</i> habitat	Poor, Fair, or Good	Good
	Population and individual plant counts of <i>B. crenulatum</i>	Numbers of populations or individual plants	2 populations totaling 9 individuals
Unique and Sensitive Plant Habitats	Change in aspen stand vigor and plant biodiversity	Acres of unique and sensitive habitats treated	98 acres
Understory Vegetation Composition	Change in amount and diversity of understory vegetation	Acres of forest canopy opened	10,255 acres of forest canopy opened.

Resource Indicator: Viability of occupied *B. crenulatum* habitat

B. crenulatum is found within two unit boundaries (units 16 and 503). Proposed treatments in these units include commercially harvesting or girdling conifers for aspen release, ladder fuel thinning in the understory, and underburning. The population in unit 16 is in an area flat enough for tractor logging, so there would be no effect from skyline cable logging. No roads are proposed over the population. There is occupied *B. crenulatum* habitat within proposed beaver habitat enhancement treatments. Design criteria have been established to protect the viability of the habitat.

This species needs some overstory, but excess shade causes an adverse, long-term, [major/moderate](#) impact by reducing the amount of light needed for this species to maintain itself.

Conversely, too much opening of the canopy around the population may make the site too hot and dry for the species. Thinning the canopy and using prescribed fire would have a long-term, moderate benefit keeping the canopy open enough for *B. crenulatum* to maintain itself, thus meeting Purpose and Need #5 to maintain and enhance existing and potential R6 Sensitive, Survey and Manage plant populations and Unique habitats within meadows and aspen stands.

The above treatments would have a long-term, ~~major~~moderate benefit to *B. crenulatum* habitats by mimicking natural effects of wildfire and reducing the likelihood of damage from wildfires that are occurring outside of their biophysical baseline conditions.

Design features and mitigation measures identified as part of Alternative 2 and 3 call for identification and avoidance of *B. crenulatum* when locating slash piles or skid trails. Design criteria also call for underburning while soils within the occupied *B. crenulatum* sites are moist in order to protect the population from intense fire that may damage this species. The equipment buffer zone for Riparian Reserves would be adequate to protect *B. crenulatum* populations occurring in close proximity to proposed unit boundaries.

Resource Indicator: Population and individual plant counts of *B. crenulatum*

Given the design features and mitigation measures, negligible to minor, short term, adverse impacts would occur to the species from harvesting, thinning, prescribed fire treatments, beaver habitat enhancements, and aquatic enhancement projects. There could be a beneficial, moderate long term impact to *B. crenulatum*; individual plant counts within these populations may increase due to decreased competition from conifers and the increased availability of nutrients, water and sunlight, meeting Purpose and Need #5. There would be a long term ~~major~~moderate beneficial impact to *B. crenulatum* populations and individual plants from the reduced likelihood of stand replacement fire from thinning and prescribed fire treatments.

Resource Indicator: Change in aspen stand vigor and plant biodiversity

A total of ten Sensitive and Unique habitats units are proposed for restoration treatments where encroaching conifers would be thinned and girdled. As a result, treatments within aspen stands would have a moderate, beneficial, long term affect by increasing plant biodiversity as well as stand vigor, and meeting Purpose and Need #5. Aspen are shade intolerant and susceptible to conifer competition and replacement in the absence of disturbance such as fire, timber harvest, or pest/disease outbreak. Conifers will eventually overtop the aspen, reducing the aspen overstory and contributing to stand collapse (Seager et al 2013), creating a moderate, long-term benefit. Openings created by conifer removal would encourage suckering of young aspen. A diverse age structure in aspen stands is beneficial, as it can provide protection against the effects of wildfire, insects and disease and browsing. There would be a long-term, moderate benefit to sensitive and unique habitats by thinning and prescribed fire treatments. Ecosystem functioning would improve by increasing the availability of water, sunlight and nutrients. Improvements could increase biodiversity in these habitats where many R6 Sensitive plant species occur. There would be a long term, ~~major~~moderate beneficial impact to unique and sensitive habitats from the reduced likelihood of stand replacement fire from thinning and prescribed fire treatments.

Resource Indicator: *Change in amount and diversity of understory vegetation*

Approximately 10,255 acres of closed forest canopies and dense patches of young trees are proposed for thinning and prescribed fire treatments. The use of slash mats ~~and single-pass travel~~ by heavy equipment used for commercial thinning during summer months would cause ~~adverse~~, short term, ~~minor-moderate~~ damage to understory vegetation. In skyline units where cables are used, there would ~~be an adverse~~, short term ~~minor, moderatedamage-impact~~ to understory. Prescribed fire would also reduce vegetation cover in the short term. Prescribed fire and thinning treatments would have a long term, ~~major-moderate~~ benefit to understory vegetation by increasing plant vigor and diversity. Thinning and prescribed fire treatments would open up the tree canopy in the analysis area, allowing more light to get to the ground and less competition for soil resources such as water. More understory vegetation would grow, with more diversity of forb and graminoid species. These treatments would meet Purpose and Need #3 by maintaining and restoring forest vegetation characteristics to within estimated historical and future ranges of variability to improve forest resiliency to insect, disease, and wildfire events. Early successional species favored by disturbance would be maintained or increase in the analysis area (Dodson and Peterson 2010; Dodson and others 2008; Ferguson and others 2011; Harrod and others 2008; McConnell and Smith 1970; Stark and others 2006; Sullivan and others 2009; Weaver 1951).

Snowberry (*Symphoricarpos albus*) occurs in portions of the analysis area. It is utilized by wildlife such as deer and grouse. Disturbance by heavy equipment operating during summer logging or prescribed fire line construction would damage snowberry tops but its underground rhizomes would allow it to persist. With more open canopy, the species could increase with time (Morgan and Neuenschwander 1988; Nelson and others 2008; Noste and Bushey 1987; Stark and others 2006).

Small amounts of willow (*Salix scouleriana*) a shrub that wildlife browse, occur in upland areas. If the top of a willow plant is damaged by logging or prescribed fire it could resprout from the roots and maintain itself (Harrod and others 2008; Leege 1979; Noste and Bushey 1987).

Strawberries (*Fragaria vesca* and *F. virginiana*) are forbs that produce berries consumed by wildlife. Strawberries can suffer damage to tops from hot fire (McLean 1969) or logging. With time, *Fragaria* tends to increase after disturbance (Armour and others 1984; Nelson and others 2008; Stark and others 2006; Sullivan and others 2008).

The shrub kinnikinnick (*Arctostaphylos uva-ursi*) produces a fruit used as food by wildlife species. Kinnikinnick is susceptible to tops of the plants burning, but with time tends to increase after prescribed fire (Harrod and others 2008; Nelson and others 2008; Sullivan and others 2008).

An increase of flowering forbs and shrubs would better support pollinators, e.g. butterflies and bumblebees (Miller and Hammond 2007; Neill and Puettmann 2013; Pengelly and Cartar 2010). This increase would be a result of proposed treatments. More pollinators would promote seed production and help maintain understory species.

Cumulative Effects

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the cumulative effects to botanical resources are within the boundaries defined by the analysis area. Analyzing cumulative effects outside the analysis areas would have no relevancy to botanical resources, as cumulative effects would be too far removed to be impactful.

The temporal boundaries 20 years into the future, the period of post-treatment understory vegetation response.

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Past Actions

In order to understand the contribution of past actions to the cumulative effects of the proposed action, this analysis relies on current environmental conditions as a proxy for the impacts of past action. This is because existing conditions reflect the aggregate impact of all prior human actions on natural events that have affected the environment and might contribute to cumulative effects.

Present and Future Actions

Of the list of past, present and reasonably foreseeable future activities, those that are pertinent to the analysis of cumulative effects to botanical resources include ongoing cattle grazing, recreation uses (including legal and illegal OHV use, snowmobiling, dispersed and developed camping, and sightseeing), firewood cutting, fire suppression, and ongoing weed control.

Figure6: Resource Indicators and Measures for Cumulative Effects

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternative 2 & 3	Past, Present, and Future Actions	Cumulative Impacts
R6 Sensitive plant <i>Botrychium crenulatum</i>	Viability of occupied <i>B. crenulatum</i> habitat	Poor, Fair, or Good	Good	Good	Good
	Population and individual plant counts of <i>B. crenulatum</i>	Numbers of populations or individual plants	2 populations totaling 9 individuals	2 populations totaling 9 individuals	2 populations totaling 9 individuals

Unique and Sensitive Plant Habitats	Change in aspen stand vigor and plant biodiversity	Acres of unique and sensitive habitats treated	98 acres	98 acres	98 acres
Understory Vegetation Composition	Change in amount and diversity of understory vegetation	Acres of forest canopy opened	10,255 acres of forest canopy opened.	10,255 acres of forest canopy opened.	10,255 acres of forest canopy opened.

Resource Indicator: Impact on occupied *B. crenulatum* habitat

Figure7: Viability of occupied *B. crenulatum* habitat Cumulative Effects

Project	Overlap In TimeSpace		Measurable Cumulative Effect?	Extent, Detectable?
Ongoing cattle grazing	Yes	Yes	No	Access to cattle is currently open, and minor amount of cattle use is evident.
Recreation uses	Yes	Yes	No	No change
Firewood cutting	Yes	Yes	No	Effects would be too small to measure.

Resource Indicator: Population and individual plant counts of *B. crenulatum*

Figure8: Population and individual plant counts of *B. crenulatum* Cumulative Effects

Project	Overlap In TimeSpace		Measurable Cumulative Effect?	Extent, Detectable?
Ongoing cattle grazing	Yes	Yes	No	Access to cattle is currently open, and minimal amount of cattle use is evident.
Recreation uses	Yes	Yes	No	Currently heavy use recreation activities are not occurring near known sensitive plant populations. Hunting is the primary recreation use near known sensitive plant populations.
Firewood cutting	Yes	Yes	No	No change

Resource Indicator: Change in aspen stand vigor and plant biodiversity

Figure9: Change in aspen stand vigor and plant biodiversity Cumulative Effects

Project	Overlap In TimeSpace		Measurable Cumulative Effect?	Extent, Detectable?
Ongoing cattle grazing	Yes	Yes	Yes	The canopy is not too dense in aspen stands that cattle cannot currently access them. Very minimal sign of cattle use currently in these stands. There is a fence surrounding Unit 501a, 501b and 501c.
Recreation uses	Yes	Yes	No	No change
Firewood cutting	Yes	Yes	No	Effects would be too small to measure.
Weed control	Yes	Yes	Yes	Populations and numbers of plants can be monitored for change.

Resource Indicator: Change in understory composition

Figure 10: Change in understory composition Cumulative Effects

Project	Overlap In Time Space	Measurable	Extent Detectable?
Grazing	Yes	Yes	Within allotment boundaries
Weed control	Yes	Yes	Moderate in the weed population areas.
Recreational activities	Yes	Yes	Minor, too small to detect
Firewood and special forest products collection	Yes	Yes	Minor, too small to detect

Conclusion

Under Alternatives 2 and 3, there would be negligible cumulative effects to the viability of *B. crenulatum* habitat or populations. The action alternatives would have a long term beneficial moderate effect by creating more transitory range, potentially changing cattle distribution in the analysis area and their access to sensitive plant populations. The *B. crenulatum* population occurs in an area where several hundred acres would be treated with thinning, ladder fuel reduction thinning, underburning or pile burning. The action alternatives would have a long-term, beneficial, minor effect on *B. crenulatum* populations because thinning and prescribed fire treatments would help create more transitory range that would disperse cattle over more ground, thereby reducing the potential for cumulative impacts from grazing and trampling. Recreational activities, firewood cutting and special forest products collections would have a long term, minor, adverse effect minimal effect on resource indicators, as they these activities involve vehicle and foot travel which can be vectors for invasive plant spread establishment. Weed control would be beneficial in and near aspen stands and in forest understories by decreasing the amount of spread and establishment of weedy species and increasing the availability of valuable resources.

Other Relevant Mandatory Disclosures

Compliance with LRMP and Other Relevant Laws, Regulations, Policies and Plans

Okanagan National Forest Land and Management Plan

S&G 6-19 addresses Sensitive species, stating, "Sensitive plants and animals should be protected." Through design criteria and mitigation measures, this project will be in compliance with FP S&G 6-19.

Lower Methow and Twisp River Watershed Analyses

In compliance with the watershed analyses, surveys were performed a year or more in advance prior to activities. Habitat for *Botrychium spp.* has been delineated for this project and will continued to be monitored.

Forest Service Manual

This project is in compliance with FSM 2670 in that a Biological Evaluation was prepared and the project is properly designed and mitigated to maintain viable populations of Sensitive plant species, and does not contribute to or trend these species toward being listed as Threatened or Endangered.

This project is in compliance with FSM 2620 in that it considers the distributions of species and habitats and ensures that habitat is provided for the number and distribution of reproductive individuals needed to ensure the continued existence of a species throughout its geographic range

Summary

A No Action Alternative would have a long term, ~~major~~moderate, adverse effect on understory vegetation by decreasing plant vigor and diversity. Dense pockets of conifers would continue to grow, leading to closed canopy with less light getting to the ground. With less light, many understory species would have a hard time growing and surviving. There would be less diversity of species and cover in understory shrub, forb, and graminoid plants. This Alternative would have a Long term, ~~major~~moderate adverse impact from canopy closure on *B. crenulatum* populations, unique and sensitive habitats and understory native plant species. It would also have along term ~~major~~moderate adverse impact on *B. crenulatum* and unique and sensitive habitats from potential stand replacement fire.

Alternative 2 and 3 would have a long term moderate beneficial impact to *B. crenulatum* populations, unique and sensitive habitats and native understory species by decreasing shade and competition for nutrients and sunlight. These two alternatives would have a long term ~~major~~moderate beneficial impact *B. crenulatum*, unique and sensitive habitats and native species from reduced likelihood of stand replacement fire. With mitigation to protect sensitive plants, Alternatives 2 and 3 would allow sensitive species to sustain themselves and maintain viability in the analysis area. Activities such as thinning, ladder fuel reduction thinning, and prescribed burning would have a long term, ~~major~~moderate benefit to understory vegetation by

opening up the canopy, favoring the growth of understory plant species. There would be more diversity and cover of understory plants.

Determination of Effects

Threatened, Endangered, and Proposed Plants

For *Howellia aquatilis* – No Effect

For *Spiranthes diluvialis* – No Effect

For *Sidalcea oregana* var. *calva* – No Effect

For *Hackelia venusta* – No Effect

Figure11: Determination of Effects for *B. crenulatum*

Species	ALT 1	ALT 2	ALT 3
<i>Botrychium crenulatum</i>	NI	MIH	MIH

BI =Beneficial Impact

MIH =May Impact Individuals Or Habitat, But Will Not Likely Contribute To A Trend Towards Federal Listing Or Loss Of Viability To The Population Or Species

NI=No Impact

WIFV = Will Impact Individuals Or Habitat With A Consequence That The Action May Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species

The proposed treatments would not lead to a trend towards federal listing or cause a loss of viability to the population, species or habitats for any of the R6 ISSSP species within the analysis area.

Degree to Which the Purpose and Need for Action is Met

Figure12: Summary comparison of how the alternatives address the Purpose and Need

Purpose and Need	Indicator/Measure	Alt 1	Alt 2	Alt 3
P&N 5: Maintain and enhance existing and potential R6 Sensitive Survey and Manage plant populations and Unique habitats within meadows and	Viability of occupied <i>B. crenulatum</i> habitat	Long term, major moderate adverse impact from canopy closure on <i>B. crenulatum</i> populations, unique and	Long term moderate beneficial impact to <i>B. crenulatum</i> populations, unique and sensitive habitatsby	Long term moderate beneficial impact to <i>B. crenulatum</i> populations, unique and sensitive habitatsby
	Population and individual plant count and vigor			

aspen stands.	Change in aspen stand vigor and plant biodiversity	sensitive habitats and understory native plant species. Long term major moderate adverse impact on <i>B. crenulatum</i> and unique and sensitive habitats from potential stand replacement fire.	decreasing shade and competition for nutrients and sunlight. Long term major moderate beneficial impact <i>B. crenulatum</i> , unique and sensitive habitats and native species from reduced likelihood of stand replacement fire.	decreasing shade and competition for nutrients and sunlight. Long term major moderate beneficial impact <i>B. crenulatum</i> , unique and sensitive habitats and native species from reduced likelihood of stand replacement fire.
P&N #3: Maintaining and restoring forest vegetation characteristics to within estimated historical and future ranges of variability to improve forest resiliency to insect, disease, and wildfire events.	Understory Vegetation Composition	Long term, major moderate adverse impact to understory vegetation by decreasing available sunlight, water and nutrients, vigor and diversity.	Long term, major moderate benefit to understory vegetation by opening up the canopy, favoring the growth of understory plant species.	Long term, major moderate benefit to understory vegetation by opening up the canopy, favoring the growth of understory plant species.

Degree to Which the Alternatives Address the Issues

Figure13: Summary comparison of how the alternatives address the key issues

Issue	Indicator/Measure	Alt 1	Alt 2	Alt 3
Impacts of thinning and prescribed fires treatments on the viability of R6 Sensitive and Survey and Manage plant populations and habitats.	Viability of occupied <i>B. crenulatum</i> habitat Population and individual plant counts of <i>B. crenulatum</i>	No impact to sensitive plants or habitat	No impact to sensitive plants with mitigation	No impact to sensitive plants with mitigation

Issue	Indicator/Measure	Alt 1	Alt 2	Alt 3
Decreased viability of aspen stands and increased competition for sunlight, water and nutrients in R6 Sensitive, Survey and Manage and native plant species from conifer encroachment.	Viability of aspen stands and R6 Sensitive plant populations and unique habitats	Long term, major moderate adverse impact from canopy closure on <i>B. crenulatum</i> populations, unique and sensitive habitats and understory native plant species.	Long term moderate beneficial impact to <i>B. crenulatum</i> populations, unique and sensitive habitats and native understory species by decreasing shade and competition for nutrients and sunlight.	Long term moderate beneficial impact to <i>B. crenulatum</i> populations, unique and sensitive habitats and native understory species by decreasing shade and competition for nutrients and sunlight.

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Appendix A: Summary of GIS Analysis Methods (optional)

If you use GIS in your analysis please include a summary of your analysis methods that includes which layers were used and how they were used.

Comment [FS-F2]: Please add appendix B and others if needed.

Appendix B: Literature

Please include a photocopy or scan of the title page or book cover for each reference that you cited – excluding forest plans and other overarching guidance. This is an important part of the project record. If we are appealed this assists the team assembling the project files and saves you having to clean your desk to find it!

Appendix C: ?

If there is additional information that you feel is important to include but is not covered elsewhere in this report (or that is not necessary for the EA), please include that information in appendices. You may include as many appendices as needed. Appendices could include critical habitat maps, PWA/IRA maps, detailed information on analysis methods, information to support assumptions you made in your analysis, etc.